CFER

Centre for Frontier Engineering Research

Annual Report 1986-87

Corporate Profile

- The Centre for Frontier Engineering Research (C-FER) is an incorporated, not-for-profit research institute of the University of Alberta established in 1983 with major funding from the Devonian Group of Charitable Foundations, the Governments of Alberta and Canada, the University of Alberta and the private sector.

- Established as a national centre of excellence, C-FER's mandate is to address those problems specifically related to materials, design and construction of facilities used in the development of Canada's petroleum resources on both the geographical frontiers of the Arctic and offshore, and on the technological frontiers of conventional, heavy oil and oil sands operations.

- Research at C-FER is focussed on two major programs: Offshore Structures and Downhole Tubular Systems. A third program aimed at improvements in productivity for shipyards and steel fabricating plants is in the developmental stages.

- The Centre's research capabilities are enhanced by a critical mix of people and facilities. Civil, metallurgical, chemical and mechanical engineers work together with corrosion specialists and other professionals. Facilities include several state-of-the-art testing machines, with access to U of A laboratories augmenting the Centre's own capabilities.

- In addition to research, C-FER is committed to a networking program designed to facilitate the movement of current, technical information through industry, governments and universities.

- Financial support and technical guidance come from C-FER Members, representatives of Canada's industry, government and university communities. More than 30 Members currently support C-FER.

University of Alberta
Edmonton

Letter to Members

1986 *marked the beginning of a significantly different era for Canada. As the year unfolded, it became increasingly clear that, in spite of a moderate rise in the price of world oil and a glimmer of renewed interest in frontier exploration, Canada's economy would not quickly return to the "glory days" of the late 'seventies. In light of this, Canada's energy industry proceeded carefully with its commitment to research and development, critically examining its priorities and its fiscal responsibilities.*

Similar caution characterized C-FER's operation during this past year. Established three years ago as a national centre of excellence, we set ourselves a challenging task... to convince Canada's industry, university and government communities that an investment in research would pay tremendous benefits and, further, that support for C-FER would give them top value for their research dollar. As we enter our fourth year, we appear to be meeting the challenges that we set. Our research programs have matured, our network continues to expand, our Member support has increased, and our financial situation is solid. The Research Trust Fund now stands at $1.2 million, with yearly contributions from the private sector (including in-kind support) now approaching $.5 million.

C-FER's concept of frontier engineering is a dual one. Our interest in Canada's geographical frontiers is reflected in a research program aimed at materials, design and construction for arctic and offshore energy development. Our commitment to the technological frontiers can be seen in a program of groundbreaking research focussed on conventional and heavy oil and oil sands operations. This combined research approach is unique in Canada and enhances our ability to take a lead role in the safe and economical development of Canada's petroleum resources.

The scope and level of activity in our research programs is determined by our Members who provide guidance for and critical assessment of our on-going efforts. There are two major programs in our research portfolio: Offshore Structures and Downhole Tubular Systems. We are pleased to report steady and substantial progress in both areas.

C-FER's mandate also includes a commitment to networking, the movement of current, technical information through industry. In the same way that our research programs have been adjusted to reflect the changing needs of industry, so, too, has the focus of the network. Now, increasing numbers of experts in downhole tubular systems take their place in the C-FER network alongside those with a particular interest in offshore structures.

C-FER Atlantic, operating out of the Technical University of Nova Scotia, developed well during this past year, with research and networking oriented towards problems of particular concern to Atlantic Canada's energy industry. Our philosophy of collaboration among university, government and industry representatives is reflected in the developing relationships between C-FER Atlantic and Canada's east coast community.

The collaborative process so critical to C-FER's operation took on an international flavour this past year. Our first Visiting Scientist, Mons Grovlen, metallurgist and research scientist at SINTEF, the Foundation for Scientific and Industrial Research at the Norwegian Institute of Technology, took up residence at C-FER for a three-month period. We also welcomed Joe Corrado, a civil engineer on leave from his position with the David Taylor Naval Research and Development Centre in Bethesda, Maryland, who spent two weeks in consultation with our research engineers. Their active involvement in our research programs was most beneficial.

A major effort of the past year was our aggressive pursuit of world-class, specialized laboratory facilities. Foreign oil is cheap and readily available. If the development of Canada's frontier petroleum resources is to become economically viable, new technologies must be developed that will result in substantial cuts in the cost of production. State-of-the-art research is the essential ingredient in this process and so we are actively negotiating with both the Governments of Alberta and Canada for their support in the establishment of a world-class Test Facility capable of full-scale testing under harsh environmental conditions. Both the proposed Low Temperature Structural Laboratory and the Tubular Products Laboratory will facilitate research which cannot now be carried out anywhere in the world. With our Members solidly behind us, we are confident that we will be successful in these negotiations and that the resulting facility will contribute to the economic viability of developing our petroleum resources.

Three of our Directors have now completed their terms on the Board: Bill Grundy, Stelco; Ray Jonasson, AMCA

The C-FER Board of Directors met three times during the past year, in Edmonton, Calgary and Toronto. Standing, left to right: Murray Todd, Ian Williams, Ed Czaja, George Miller and Bill Grundy. Seated: Ernie Pallister (Chairman of the Board) and Peter Adams (President).

International; and Gordin Kaplan, University of Alberta. Their support and guidance for our Centre has been substantial and we thank them for it. We have recently welcomed three new Directors: Mike Bregazzi, Gulf Canada Corporation; Grant Gunderson, Mobil Oil Canada; and Bob James, University of Alberta. They bring to the Board a wealth of experience and we look forward to their involvement.

We have said before that the success of our Centre is due in large measure to the commitment of the Board. It bears repeating, for the time and energy devoted by our Directors has had a tremendous impact. Their personal involvement in and stewardship of our research and networking efforts has resulted in an overall program which is in tune with the needs of our Members. Their continued counsel will be invaluable.

The long-term commitment to C-FER of the University of Alberta is of prime importance. As an applied research arm of the University, we enjoy a synergistic relationship with faculty and students alike. This collaboration is a key factor in the successful development of our research programs. In addition, office space and access to lab facilities enhance our ability to operate effectively.

Clearly, the staff play a pivotal role in the work of our Centre. Civil, metallurgical, chemical and mechanical engineers working together with corrosion specialists and other professionals are afforded an opportunity to take part in a unique and challenging research experience. The dedication, drive and innovation of these bright young engineers and research scientists is the backbone of our efforts.

Finally, we acknowledge our Members, representatives of Canada's industry, government and university communities who share our vision of collaboration. This has been a year

Board of Directors

Dr. A.E. Pallister
President
Pallister Resource Management Ltd.
(Chairman of the Board)

Dr. M. Bregazzi
Vice-President, Development
Gulf Canada Corporation

Dr. A.E. Collin
Special Advisor to the Minister
Privy Council Office
Government of Canada

Mr. J.E. Czaja
Executive Vice-President
Shell Canada Limited

Mr. G.D. Gunderson
Manager, Heavy Oil
Mobil Oil Canada, Ltd.

Dr. C.R. James
Vice-President, Research
University of Alberta

Dr. G.B. Miller
President and Director of Research
NOVA/Husky Research Corporation

Mr. M.B. Todd
Senior Vice-President
Production and Development
Dome Petroleum Limited

Mr. I.E. Williams
Group Sales Manager
Fabrication and Heavy Manufacturing
The Algoma Steel Corporation

Ernie Pallister

Peter Adams

of hardship and uncertainty that has touched all aspects of Canada's economy. That we have increased our roster of Members during this period of fiscal restraint is clear recognition that the philosophy of collaboration exemplified by C-FER is the operative one. Equally important, increased financial support speaks well of the Centre's mandate and management strengths.

This vote of confidence is most rewarding, but we must not become complacent. We have established a reputation as a national centre of excellence. We have faced the economic reality before us and have adjusted our actions accordingly. Our belief that research is the essential ingredient in the future development of our energy resources remains intact. We must continue diligently in the vein which has characterized our efforts of the past year. We must be cautious yet innovative, flexible yet tenacious as we move our research forward. Our goal is to channel our energies and our imaginations, focus them on the development of new and pragmatic technologies so critical to the successful development of Canada's frontier resources.

A.E. Pallister
Chairman of the Board

P.F. Adams
President

Research Report

Murray Todd, Chairman Research Policy Committee

This has been a year of consolidation and expansion. Shifts in the world energy economy triggered a re-evaluation of C-FER's technical focus. The value of both research programs, Offshore Structures and Downhole Tubular Systems, was affirmed at the policy level. Designs and techniques being developed at C-FER are required for the development of conventional and frontier petroleum reserves. Increased emphasis will be placed on technology for cost reduction, to contribute to the feasibility of development under likely world price scenarios.

While maintaining the technical focus of these two programs, a third, to be added in the area of Fabrication Productivity, will explore improved industrial competitiveness from both technological and management perspectives.

Strong industry input continues as a cornerstone of the C-FER operation. Project Committee meetings have been held for several of the most active projects. The Technical Council, chaired by Ian Williams (Algoma) met twice to assess priorities and progress in the research programs. Under the leadership of Murray Todd (Dome), the Research Policy Committee met three times to provide overall policy direction for C-FER's research thrust. Other members of the Research Policy Committee are: Art Collin (Privy Council Office), Dave Fleming (Shell), John Hood (Stelco), John Loh (Gulf), and Roy Millar (Esso).

"The value of research programs has been affirmed at the policy level..."

C-FER is also bringing together basic knowledge in academia with the technology needs of industry. In addition to numerous informal contacts, eight engineering faculty provide expertise as part of C-FER project teams: five at the University of Alberta, two at the Technical University of Nova Scotia, and one at the University of Calgary. As well, collaboration with both the University of Alberta and the Alberta Research Council, which provide lab space and support facilities, has been of material benefit.

"Initial projects have started to bear fruit..."

C-FER Atlantic has enjoyed similar backing from TUNS and has started to move forward on projects generated with local industry.

Initial research projects have started to bear fruit, with several final reports now available for C-FER Members. In addition, C-FER's human resources were enhanced during this past year. The expertise of C-FER research staff is being recognized by Members, as evidenced by an increasing flow of highly specialized contract research. Several apparatii have recently been constructed to support researchers in their laboratory work, equipment ranging from scanning reference electrodes to the sucker rod/tubing wear testing machine.

In summary, C-FER's potential as an industry-driven, technically-focussed research centre is being realized.

Offshore Structures Research

CSA Code for the Design, Construction and Installation of Offshore Structures.

Response of Steel Members Under Various Loading Rates and Temperature Conditions.

- Literature Review - Brittle Fracture: Mechanics, Testing and Design.
- Rupture Strains for Stiffened Plate Panels.
- Toughness Requirements for Offshore Steel Structures Used in Arctic Environments. *
- Fracture Assessment - Strain Energy Density Approach.

Field Assessment of Weld Corrosion on the M.V. "Arctic". *

Design and Behaviour of Composite Ice-Resisting Walls.

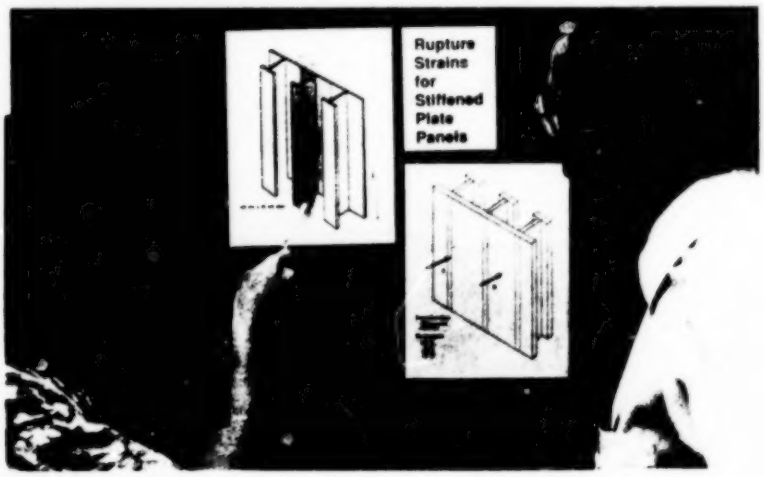
Enhanced Analytical Methods for Offshore Structures.

- Finite Element Analysis of SSDC "Steel Mat". *

Development of Short-Term Laboratory Tests to Evaluate Corrosion Susceptibility of Welds.

* *Contract Research*

C-FER researcher Raja Voruganti (above, left) discusses his investigations into the corrosion susceptibility of welds in arctic marine plate with Ken Morrison, Director of C-FER Atlantic.



As part of C-FER's Offshore Structures program, tests were conducted (left) to assess the capacity of a composite wall to resist punching shear. Project Officer for that work, Tom Zimmerman (above, right) and Karen Baker discuss the structural arrangement of a proposed test specimen for her research on rupture strain criteria for stiffened plate panels.

The fabrication of a large-scale testing machine was an important milestone in the sucker rod/tubing wear project. Actual components are now being subjected to realistic contact forces and stroke rates in order to develop wear-reducing guidelines. The specimen (upper left) typifies the rapid wear which can occur in highly deviated wells.

Downhole Tubular Systems Research

Experimental Investigation of Make-up Procedures for Tubular Connections.

- Development of Prototype Ultrasonic Reflection Amplitude Pressure Tool.
- Measurement of Coefficients of Friction for Thread Compounds at High Pressures.

Sucker Rod/Tubing Wear in Deviated Wells.

- Laboratory Investigation of Sucker Rod/Tubing Wear.
- Field Study of Wear Problems in Oil Production.

Finite Element Analysis of Tubular Connections - Structural and Leakage Integrity.

- Three Dimensional Finite Element Analysis of Threaded Connections.

Casing/Formation Interaction Model for Thermal Recovery Wells.

Evaluation of X56 Casing Subject to Large Tensile Strains and External Pressures. *

Effect of Cold Work on Sulphide Stress Cracking of High Strength Casing Steel.

Evaluation of Sulphide Stress Cracking Resistance of High Strength Casing. *

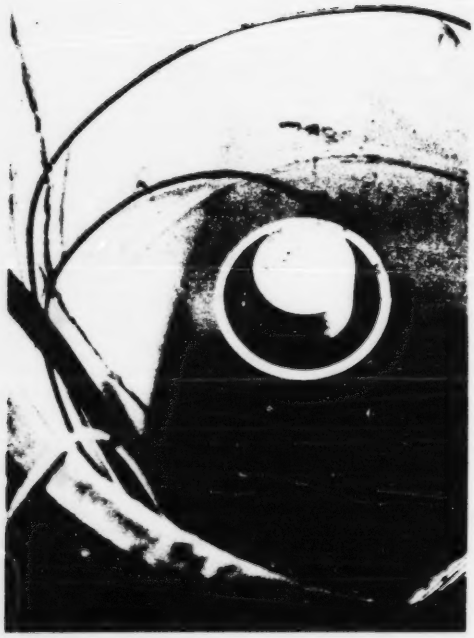
Casing Design - Strain Limit Approach. *

Evaluation of 178 mm Premium Casing Connection for Heavy Oil Service. *

* *Contract Research*

C-FER and the University of Alberta are involved in a collaborative project which examines the effect of cold work on sulphide stress cracking of casing. Project Officer Kathy McKenzie (left) mounts a specimen cut from high strength casing, in preparation for loading in a hydrogen sulphide saturated solution.

The development of a computer model to assess casing/formation interaction will benefit drilling engineers designing thermal recovery wells. Project Officer is Terry Marion (far left). Senior Research Specialist seconded to C-FER by Esso Resources Canada. Keith Kosar, a doctoral student at the U of A, is the geotechnical specialist assigned to the project team.



Project Officer Maurice Slack (above, right) explains the URAP technique to VAM Canada Production Manager Gerry Beaulac. The new instrument developed by C-FER is capable of directly measuring seal surface pressures in premium connections.

In addition to its core research program, C-FER undertakes contract research. In one such project completed during the past year, C-FER engineers evaluated casing subject to large tensile strains and external pressures and supervised subcontract testing at an external laboratory. Shown (above) is a casing specimen mounted and ready for pressure testing.

Membership and Networking Report

Membership and networking met with continued success in 1986. During the year, the mandate of the Board Membership Committee was expanded to take on the additional responsibility for the Centre's networking initiative. The restructured committee was chaired by C-FER Director Bill Grundy (Stelco); other members of the committee were Ed Czaja (Shell) and Ray Jonasson (AMCA International).

Membership in C-FER has continued to rise, with an increase of nearly 25 percent this past year. With this increase has come an expanded private sector representation, with Membership now stretching from British Columbia to Nova Scotia. This financial and technical support from Canada's frontier engineering community is particularly encouraging in light of the continued economic downturn of the past twelve months. It is also a key to C-FER's continued success, and so, committee members and senior C-FER staff alike continued an active program of visits to private sector companies in order to outline both the Centre's research projects and the benefits of Membership.

"Private sector support continues to increase..."

A major accomplishment of the Committee during this past year was the development of a Memorandum of Understanding which defines Membership benefits and clarifies the parameters and

Bill Grundy, Chairman
Membership and Networking Committee

Membership Benefits

- Direct access to C-FER staff;
- Advance knowledge of research in progress and of preliminary and final results;
- Eligibility for membership on the C-FER Board of Directors and its various standing committees;
- Membership on the Technical Council (a panel of industry experts who provide critical assessment of and future direction for specific research projects) and on its project committees;
- Preferred access to C-FER for purposes of contract research;
- Preferred consideration for C-FER research subcontracts;
- Access to all C-FER publications including confidential reports, technical papers (at reduced cost) and newsletters;
- Preferred cost and registration at all C-FER sponsored workshops, seminars and conferences;
- Priority access to C-FER's information services.

C-FER Members

Consulting Companies

AOE Consultants
EBA Engineering
The Engineers Collaborative
GEOTECHnical resources
Hanson Materials Engineering
Kasten, Eadie Engineering
Martec
Reid Crowther
Stanley Associates Engineering
Sandwell Swan Wooster
Viatec Resource Systems

Energy Industry

Bow Valley Industries
Diversified Drilling Services
Dome Petroleum
Esso Resources Canada
Gulf Canada Corporation
NOVA, An Alberta Corporation
Petro-Canada Resources
Shell Canada
Syncrude
Vam Premium Connections
Weatherford Oil Tool

Steel Industry

Algoma Steel
AMCA International
IPSCO
Stelco

Foundations

Devonian Group of Charitable Foundations

Government

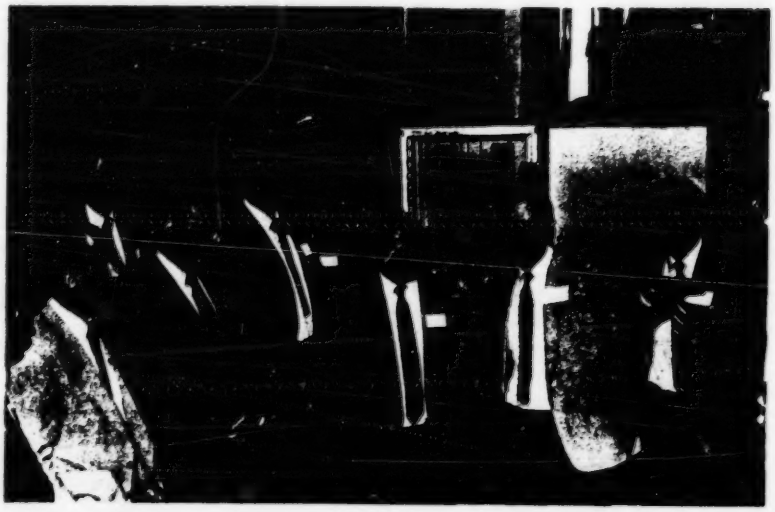
AOSTRA
Government of Alberta
Government of Canada
National Research Council

Universities

Technical University of Nova Scotia
University of Alberta

reciprocal responsibilities between C-FER and its Members. An agreement was also established for collaborative members emphasizing the exchange of non-proprietary information. This agreement will help strengthen the collaboration which already exists not only between C-FER and several university-based research centres across Canada but also with various international organizations.

Networking, facilitating the movement of current, technical information through industry, has been a commitment of the Centre from the outset. The expansion of the Board committee's mandate to include this activity reflects the importance attached to it, and provides a mechanism for its on-going accountability. It also reflects the synergistic relationship between membership and networking activities.



A major benefit of Membership in C-FER is the opportunity to guide core research. Members of the Technical Council meet regularly with C-FER staff to assess the Centre's on-going research programs.

While the key ingredient of the networking program continues to be person-to-person contact, workshops and seminars, information and consulting services, and publications and public relations are the tools used to link together nearly 1,000 of Canada's leading technical specialists.

Again this past year, workshops ed to be a most effective means of enhancing technology transfer. The fourth and fifth seminars in the series on Northern and Offshore Information Resources (NOIR), sponsored jointly by C-FER and the Arctic Institute of North America, were held during 1986, once in Yellowknife, in conjunction with the annual meeting of the Association of Canadian Universities for Northern Studies, and again in Edmonton, in conjunction with the 25th anniversary conference of the Boreal Institute for Northern Studies. The NOIR seminar series, widely recognized as a successful means of collaboration, will be continued.

Several technical workshops were organized during the year including two two-day sessions on Ice/Structure Interaction and a day-long seminar on Toughness Requirements for Steel in Offshore Structures. In addition, plans were firmed up for two special symposia honouring C-FER Fellows Ben Gerwick

"The key ingredient in the network is person-to-person contact..."

University Collaboration

The University of Alberta was a founding Member of C-FER and its support has been a critical element in the Centre's successful development. Both research and networking have benefitted from the professional counsel provided by the University for C-FER's on-going programs. The following members of the University's Faculty of Engineering are currently acting in an advisory capacity to C-FER projects:

- Dr. S.A. Bradford
  Mining, Metallurgical and Petroleum Engineering
- Dr. A.E. Elwi
  Civil Engineering
- Dr. J.G. MacGregor
  Civil Engineering
- Dr. D.W. Murray
  Civil Engineering
- Dr. J.D. Scott
  Civil Engineering

In addition to the collaboration in place with the University of Alberta, formal links have also been established with both the Technical University of Nova Scotia and the University of Calgary:

- Dr. A. Ghali
  Civil Engineering
  University of Calgary
- Dr. G.M.C. Lee
  Mining and Metallurgical Engineering
  Technical University of Nova Scotia
- Dr. K.G. Leewis
  Mining and Metallurgical Engineering
  Technical University of Nova Scotia

Workshops play a key role in the movement of current, technical information through industry, government and university specialists linked together by the C-FER network.

and Alan Davenport; these international sessions are expected to have broad appeal.

Networking is also a priority of C-FER Atlantic, an east coast arm of the Centre operating out of the Technical University of Nova Scotia. Working in collaboration with CANMET, C-FER Atlantic held a workshop on Cathodic Protection at which nearly 60 delegates from Canada, the United States, Great Britain and Japan gathered together.

Recognizing the effectiveness of the C-FER network, both the Science Institute of the Northwest Territories and the Arctic Institute of North America sought guidance from C-FER as they developed goals, objectives and *modus operandi* for similar operations. In addition, the network was featured at a Science Council of Canada conference on University/ Industry Research Centres.

The close of the year brought with it the conclusion of the three-year contract with Energy, Mines and Resources Canada which was instrumental in the creation of the C-FER network. The support of EMR, particularly CANMET, the Canada Centre for Mineral and Energy Technology, has played a pivotal role in the development of the networking initiative.

"The support of Energy, Mines and Resources Canada has played a pivotal role in the success of the network..."

The continued success of C-FER's networking program will depend on two things: first, the Centre's ability to be both proactive and reactive, meeting the changing needs of its many constituent groups; and, secondly, the on-going support of its Member companies, the clear recognition that the network should continue to be an integral part of C-FER's mandate.

Auditor's Report

To the Members of the
Centre for Frontier Engineering Research Institute

I have examined the balance sheet of the Centre for Frontier Engineering Research Institute as at March 31, 1987 and the Operating Account statement of income, expenditure and surplus and the Research Trust Fund statement of income, expenditure and unexpended funds for the year then ended. My examination was made in accordance with generally accepted auditing standards, and accordingly included such tests and other procedures as I considered necessary in the circumstances.

In my opinion, these financial statements present fairly the financial position of the Centre as at March 31, 1987 and the results of its operations for the year then ended in accordance with generally accepted accounting principles applied on a basis consistent with that of the preceding year.

Donald D. Salmon
C.A.
Auditor General

Edmonton, Alberta
June 2, 1987

Centre for Frontier Engineering Research Institute
Balance Sheet
as at March 31, 1987

Assets	**1987**	1986
Current:		
Cash	**$ 33,188**	$ 66,149
Deposits in trust with the University of Alberta (Note 5) *	**904,071**	762,486
Term deposits	**--**	50,000
Accrued interest	**3,264**	6,114
Accounts receivable	**85,171**	110,558
Prepaid expenses	**1,073**	340
	1,026,767	995,647
Fixed assets, at cost (Note 6)	**130,483**	19,605
Less: Accumulated depreciation	**44,295**	7,392
	86,188	12,213
	$1,112,955	$1,007,860
Liabilities and Equity		
Current:		
Accounts payable	**$138,908**	$ 72,664
Share capital (Note 7)	**9**	3
Surplus, Operating Account	**39,060**	60,510
Unexpended Funds, Research Trust Fund	**934,978**	874,683
	$1,112,955	$1,007,860

* *The accompanying notes are part of these financial statements.*

Centre for Frontier Engineering Research Institute
Operating Account
Statement of Income, Expenditure and Surplus
for the year ended March 31, 1987

Income	**1987**	1986
Transfer from Research Trust Fund	**$1,150,015**	$ 997,972
Contract fees	**185,543**	140,000
Other income	**6,549**	11,938
Contributions in-kind (Note 8)	**261,500**	315,055
	1,603,607	1,464,965
Expenditure		
Salaries and benefits	**788,547**	719,685
Materials and supplies	**144,524**	149,909
Consultants	**116,707**	29,667
Travel and promotion	**115,443**	97,030
Space rental	**50,979**	40,434
Telephone, postage and courier	**44,985**	57,526
Computer	**43,446**	15,896
Depreciation	**36,903**	5,234
Honoraria	**10,000**	10,000
Equipment rentals	**7,993**	22,099
Miscellaneous	**4,030**	13,507
In-kind support	**261,500**	315,055
Program expenditures, Schedule 1 (Note 9)	**1,625,057**	1,476,042
Excess of expenditure over income for the year	**(21,450)**	(11,077)
Surplus at beginning of year	**60,510**	71,587
Surplus at end of year	**$ 39,060**	60,510

Centre for Frontier Engineering Research Institute
Research Trust Fund
Statement of Income, Expenditure and Unexpended Funds
for the year ended March 31, 1987

Income	**1987**	1986
Contribution from the Province of Alberta (Note 10)	**$ 401,000**	$ 376,000
Contributions from industry	**312,000**	194,000
Contribution from the Devonian Group of Charitable Foundations (Note 11)	**200,000**	200,000
Contribution from the Government of Canada (Note 12)	**200,000**	180,000
Contribution from the National Research Council of Canada (Note 13)	**50,000**	50,000
Contribution from the University of Alberta	**--**	27,972
Interest	**47,310**	42,412
	1,210,310	1,070,384
Expenditure		
Transfer to Operating Account	**1,150,015**	997,972
Excess of income over expenditure for the year	**60,295**	72,412
Unexpended funds at beginning of year	**874,683**	802,271
Unexpended funds at end of year	**$ 934,978**	$ 874,683

Approved by the Board:

Director

Director

Centre for Frontier Engineering Research Institute
Notes to the Financial Statements
March 31, 1987

Note 1 Authority

The Centre for Frontier Engineering Research Institute was incorporated on November 7, 1983 under the provisions of Part IX of the Companies Act of Alberta as a not-for-profit limited company.
The Centre conducts research related to materials, fabrication processes, and other facilities required for energy related developments in the Arctic, offshore and other Canadian frontier regions.

Note 2 Significant Accounting Policies

(a) Contributions in-kind: The costs of various services provided without charge to the Centre by industry, universities and government are recorded as income of the Centre and are also recorded as program expenditures.
(b) Depreciation: Furniture and equipment are depreciated using the reducing balance method at a rate of 30%. Research equipment is depreciated on a straight-line basis over its estimated useful life, ranging from one to five years.

Note 3 Changes in Financial Position

A statement of changes in financial position is not provided as disclosure in these financial statements is considered to be adequate.

Note 4 Relation to the University of Alberta

The University of Alberta is a Member of the Centre for Frontier Engineering Research Institute (C-FER) and appoints one member of the Centre's Board of Directors. The University is also the owner of C-FER's building and certain equipment. These assets are not disclosed in these financial statements. In the event that C-FER is terminated, facilities and equipment provided or acquired for C-FER shall become the absolute property of the University.

Note 5 Deposits in Trust with the University of Alberta

In accordance with the terms of agreements between the Centre and the Province of Alberta, and between the Centre and the Devonian Group of Charitable Foundations, contributions to research programs are deposited for credit to the Research Trust Fund. This Fund is administered by the Comptroller of the University of Alberta as trustee.

Note 6 Fixed Assets

Fixed assets are summarized as follows:

	1986			1985
	Cost	Accumulated Depreciation	Net Book Value	Net Book Value
Furniture and fixtures	$41,261	$17,553	$23,708	$12,213
Research equipment	89,222	26,742	62,480	--
	$130,483	$44,295	$86,188	$12,213

Note 7 Share Capital

Authorized capital:	20,000 shares without nominal or par value.
Issued capital:	9 shares at $1 each.

Note 8 Contributions In-kind

Contributions in-kind were provided by the following:

Industry	**1987**	1986
Esso Resources	**$87,500**	$ --
Dome Petroleum	**75,000**	240,000
Sandwell Swan Wooster	**7,000**	--
The Engineer's Collaborative	**1,000**	--
	170,500	240,000
Universities		
University of Alberta	**76,000**	35,055
Technical University of Nova Scotia	**15,000**	15,000
	91,000	50,055
Government		
Government of Canada	**--**	25,000
	$261,500	$315,055

Note 9 Manpower Grants

Program expenditures have been reduced by the following amounts received as manpower grants:

	1987	1986
Province of Alberta, Department of Career Development and Employment	**$11,291**	$ 6,780
Government of Canada	**15,323**	17,450
	$26,614	$24,230

Note 10 Contribution from the Province of Alberta

The contribution from the Province of Alberta consists of $376,000 and $25,000 received from the Department of Technology, Research and Telecommunications and the Alberta Oil Sands Technology and Research Authority respectively. Under the terms of an agreement between the Centre and the Province of Alberta, the Centre is to receive funding in the amount of $376,000 per year until January 31, 1988, subject to certain restrictions.

Note 11 Contribution from the Devonian Group of Charitable Foundations

The contribution from the Devonian Group of Charitable Foundations was received under the terms of an agreement between the Centre and the Group providing for total funding of $2,500,000 by January 1, 1988, subject to certain restrictions.

Note 12 Contribution from the Government of Canada

The contribution from the Government of Canada was received under the terms of an agreement between the Centre and the Government of Canada providing for total funding of $1,000,000 by March 31, 1990, subject to certain conditions.

Note 13 Contribution from the National Research Council of Canada (NRC)

The contribution from the National Research Council of Canada was received under the terms of a contribution agreement between the Centre and NRC providing for funding of $50,000 for the year ended March 31, 1987. The agreement is eligible for annual renewal.

Note 14 Comparative Figures

The 1986 figures have been reclassified where necessary to conform to 1987 presentation. Comparative figures are not provided for Schedule 1 because some projects within the program are completed within the fiscal year.

Note 15 Approval of Financial Statements

These financial statements were approved by management.

Schedule 1

Centre for Frontier Engineering Research Institute
Schedule of Program Expenditures
for the year ended March 31, 1987

	Expenditures In-kind	Other Expenditures	Total
Offshore Structures	$113,551	$464,036	$577,587
Downhole Tubulars	110,773	342,296	453,069
Networking	14,342	210,935	225,277
Corporate Development	15,056	206,733	221,789
Administration	7,778	139,557	147,335
	$261,500	$1,363,557	$1,625,057